

Space-Time Co-Evolution of the Surface Wave and Langmuir Turbulence Fields

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LONG-TERM GOALS

The goal is to understand, and ultimately parameterize for routine use, the form and effects of Langmuir Circulation on mixing and mixed layer development under non-equilibrium conditions (e.g., rising or veering winds).

OBJECTIVES

The objective of this project is to map the transient Langmuir cell field and the coincident pattern of wave breaking, along with key statistical metrics such as the wave directional spectrum, wind stress and buoyancy flux, along with the evolution of the upper-ocean profiles of currents and turbulence levels.

APPROACH

We plan to field three sensing systems from the Research Platform FLIP as an aspect of the Langmuir DRI. These have the potential to quantify the space-time evolution of the surface wavefield, wave breaking, and Langmuir development. Along with AUV, airborne and FLIP-based sensors fielded by colleagues, we will have the potential to significantly advance understanding of mixed layer physics.

The sensors proposed here include an existing 200 kHz Phased Array Doppler Sonar (PADS); a Wirewalker vertically profiling instrument package equipped with a CTD, current meter, fluorometer and turbulence sensors; and a floating, kilometer-long optical fiber temperature array that can make direct measurement of sea-surface temperature on 10-meter, 1- minute scales. The temperature array can identify microfrontal structures in the mixed layer and, potentially, the thermal signature of Langmuir cells and nocturnal convection.

WORK COMPLETED

As our funding has only just started, we are still mainly at the stage of planning. We are sketching out the engineering and logistical needs to bring the equipment up to a “sea-ready” condition, and deploy them on R/V FLIP.

RESULTS

No results as yet.

IMPACT/APPLICATIONS

Understanding and being able to estimate the effects of LC on the oceanic mixed layer under rapidly-evolving conditions could be transformative in predicting the results of intense air/sea interactions that typically occur under such circumstances.

RELATED PROJECTS

All projects proceeding under the Langmuir Circulation DRI are in some sense related. These include projects under PIs Melville (SIO), Terril (SIO), D’Asaro (UW), and many others. We (Smith, Pinkel, Lucas) do not have other projects related to this one at this time.